NESDIS Data System Readiness

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NESDIS/ORA/CRAD
February 14, 2002

Near-real-time distribution of AIRS for NWP data assimilation

Goals:

- Provide AIRS/AMSU/HSB data and products to NWP centers in near-real-time --- generally 3 hours from observation time.
- Demonstrate positive impact in NWP.
- Demonstrate processing and utilization of high spectral resolution infrared data in preparation for CrIS and IASI.

Why NESDIS?

- NASA processing does not meet NWP time requirements.
- NESDIS has well established customer relationships with NWP centers.
- Science team status – natural partners with NASA and JPL
- Science investigations are facilitated with full accessibility to AIRS data.

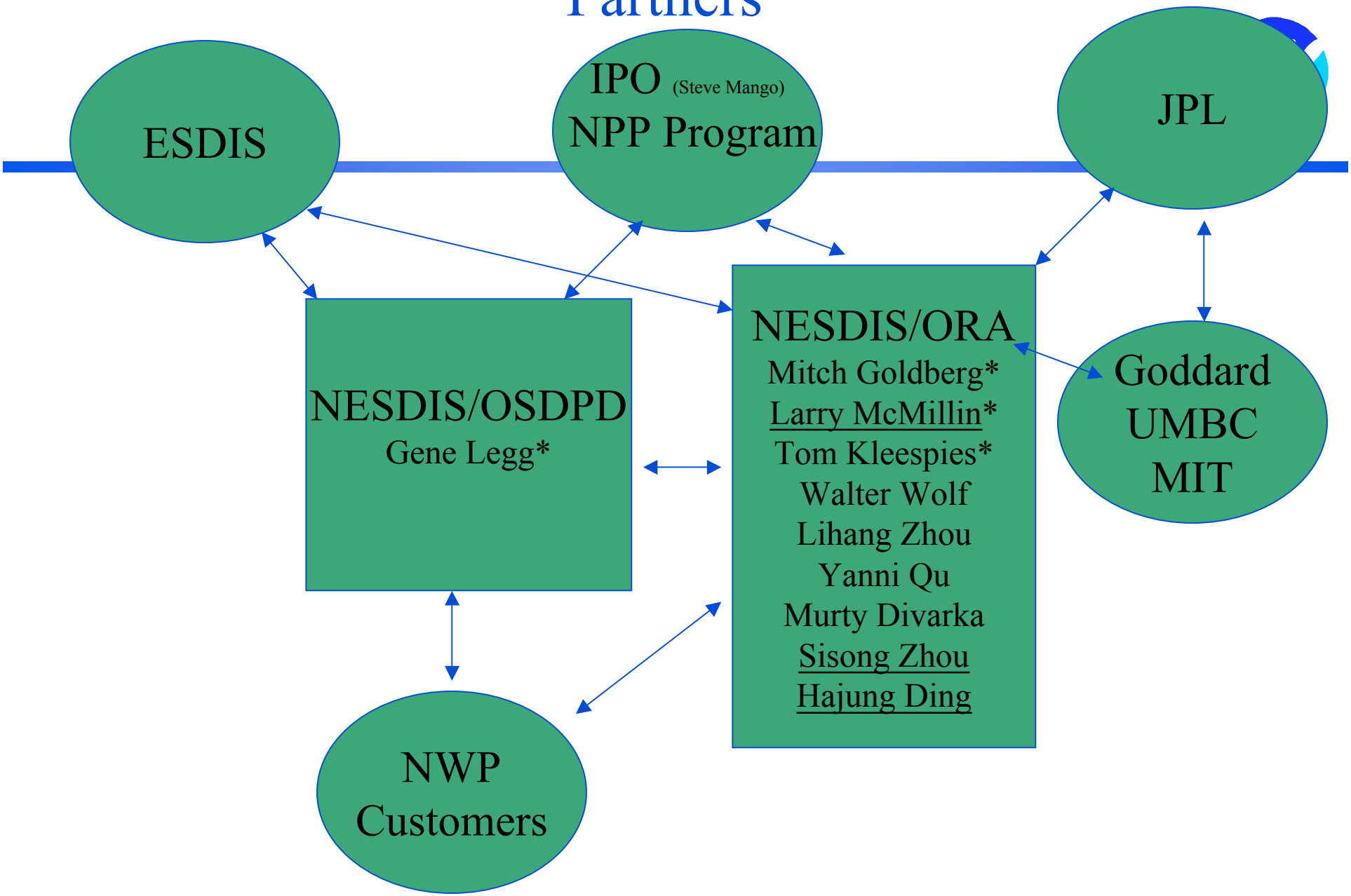
Science Investigations

- Data compression.
- Validate and improve radiative transfer calculations.
- Cloud detection and clearing.
- Channel selection (super channels).
- Validate and improve retrieval algorithms.
- Use MODIS to improve AIRS cloud detection
- Forecast impact studies
- Radiance vs retrieval assimilation trade-off studies
- Trace gas
- Surface emissivity

NWP Users

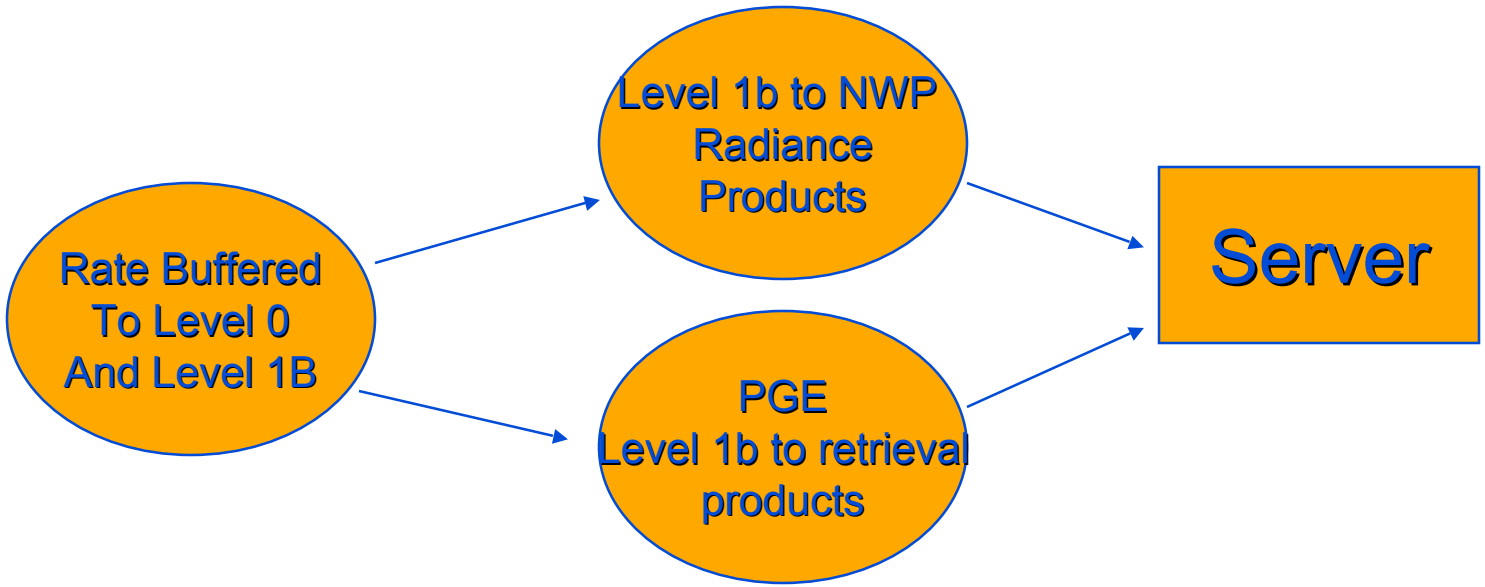
- NCEP
- ECMWF
- Met. Office
- Meteo-France
- Goddard DAO
- Meteor. Service of Canada
- Bureau of Meteorology Research Centre (Australia)

Partners


ESDIS
IPO (Steve Mango)
NPP Program
JPL
NESDIS/OSDPD
Gene Legg*
NESDIS/ORA
Mitch Goldberg*
Larry McMillin*
Tom Kleespies*
Walter Wolf
Lihang Zhou
Yanni Qu
Murty Divarka
Sisong Zhou
Hajung Ding
Goddard
UMBC
MIT
NWP
Customers

AIRS near real-time processing

- EOS data is received at Goddard
- NESDIS computers are located at Goddard
- Products are stored on a server at Goddard
- Users gets the data via FTP.



Real Time Data Acquisition

- Downlink Stations -- Fairbanks, Alaska and Svalbard, Norway
- EOSDIS -- Goddard Space Flight Center
- Data Processing Machine
- 1 to 2.5 hours for the data to be received at the processing machine

Real Time Data Processing

- Raw Data Packets (Rate Buffered Data)
- Convert Packets to Level 0 format (< 5 minutes)
- Level 0 to Level 1B -- JPL Code Approximately 20 minutes.
- Level 1B to deliverable products (< 5 minutes).

NOAA EOS Processing System

- Current -
- 32 CPU SGI Origin 2000 R10K
  - » 20 CPUs for AIRS
  - » 12 CPUs for MODIS
- 720 GB RAID
- O2 Control Console

Hardware Upgrade

- NASA NPP project has provided to NOAA 96 CPUs (SGI ORIGIN 3800 RS12K) for MODIS and AIRS processing. (64 MODIS ,32 for AIRS) 8 TB storage
- Server - SGI Origin 3200 dual processor - 6 TB
- 20 RS10K + 32 RS12K CPUs dedicated to AIRS
- At least 7 TB for AIRS

NWP AIRS Products

- Thinned Radiance files - BUFR and HDF

  a) center of 3 x 3 from every other AMSU fov,
  ~300 channels. + AMSU and HSB (8 mbytes per orbit)

  b) 200 principal component scores using same thinning as a)

  c) Every 2nd 3 x 3 AIRS fovs (~300 channels)
  plus all AMSU and HSB (all 3 x 3)

  d) cloud cleared a) and b)

  e) Full resolution AMSU and HSB

  * all include cloud indicator

- Full resolution level 2 products – temperature, moisture and ozone.

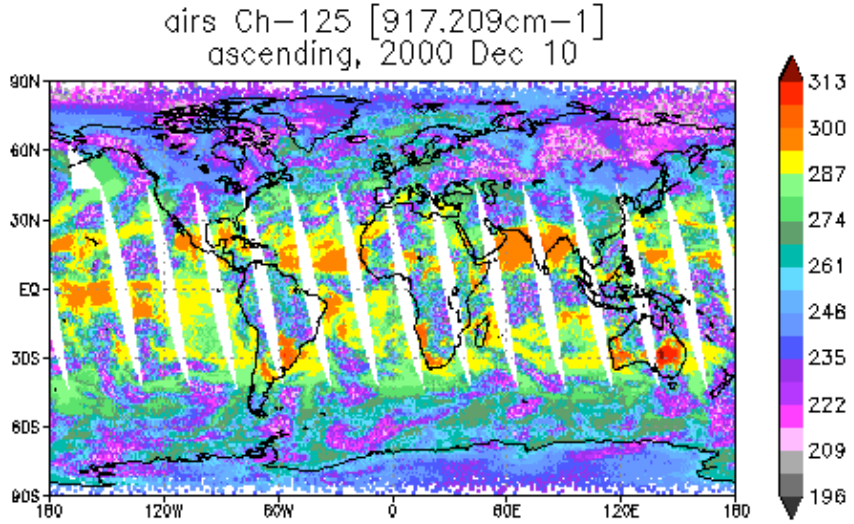
Deliverable AIRS BUFR Files

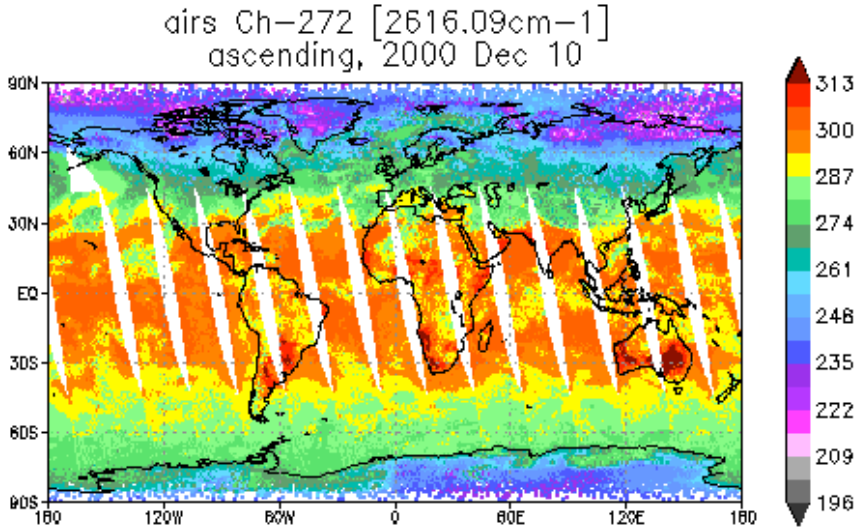
- Originally based off TOVS BUFR Format
- One BUFR file per granule
- Center Field of View for every other golf ball
- 281 AIRS Infrared Channels, 4 AIRS Visible Channels, 20 Cloud Tests, 1 Cloud Flag, 15 AMSU Channels, and 4 HSB Channels
- Each file is approximately 520 KB

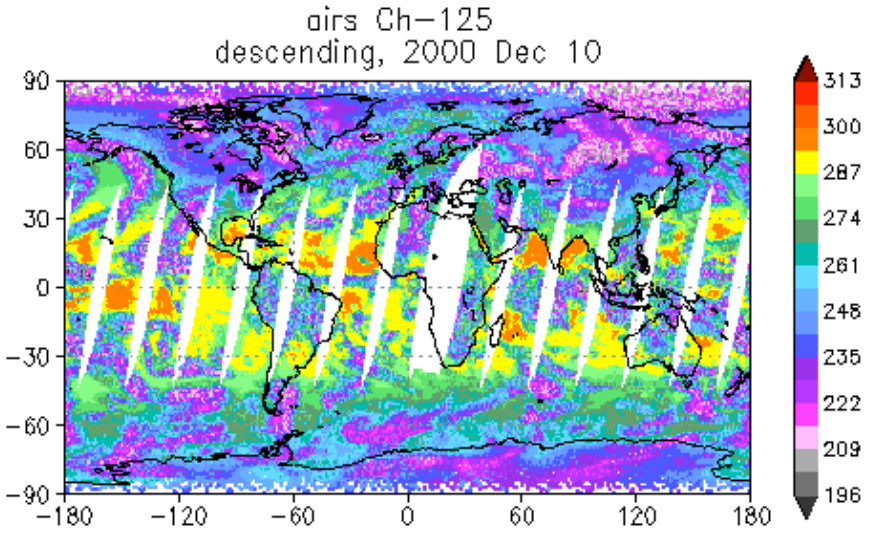
Preparing for AIRS

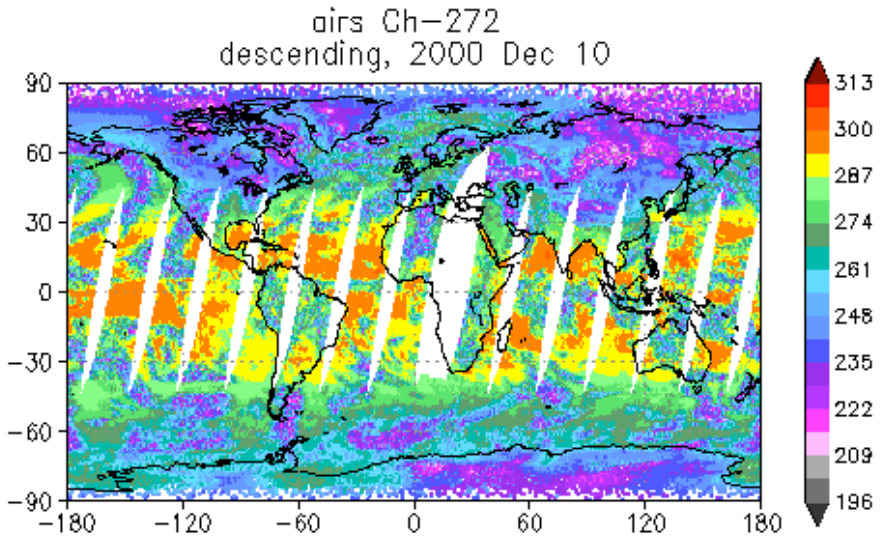
- Simulating AIRS/AMSU-A/HSB data in real-time from the NCEP 6-hour forecast since April 2000.
- Deriving NRT level 2 retrievals since June 2001.
- All products generated in near real-time and stored on FTP server.
- Providing AIRS OPTRAN forward model to NCEP
- Developed clear fov tests.
- Developed offline system to validate AIRS radiances, products and to generate retrieval coefficients and radiance bias adjustments.

Example of simulated AIRS window channels: LW, SW

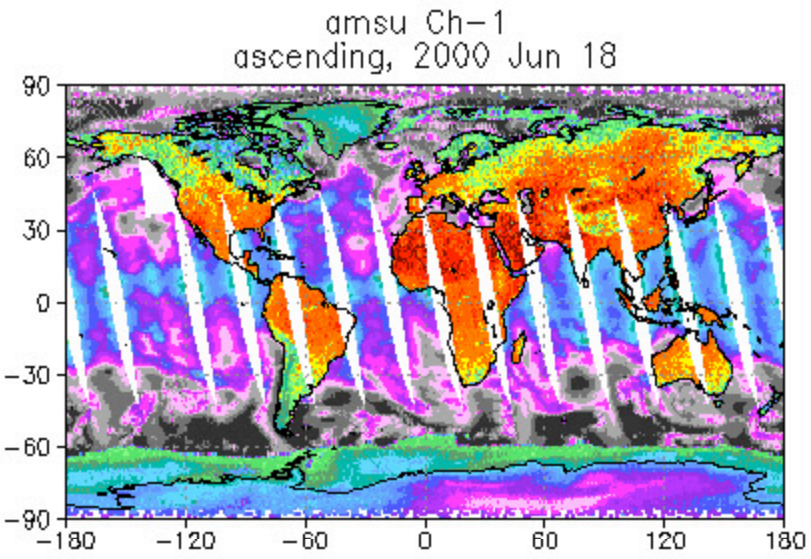


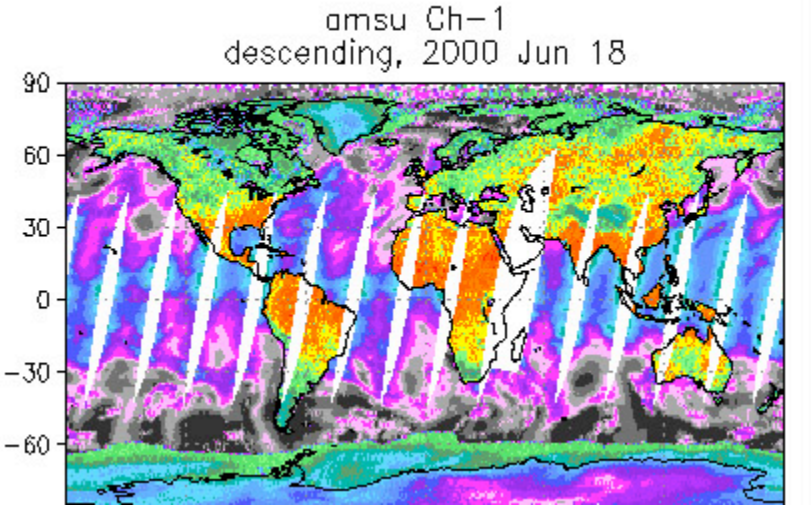




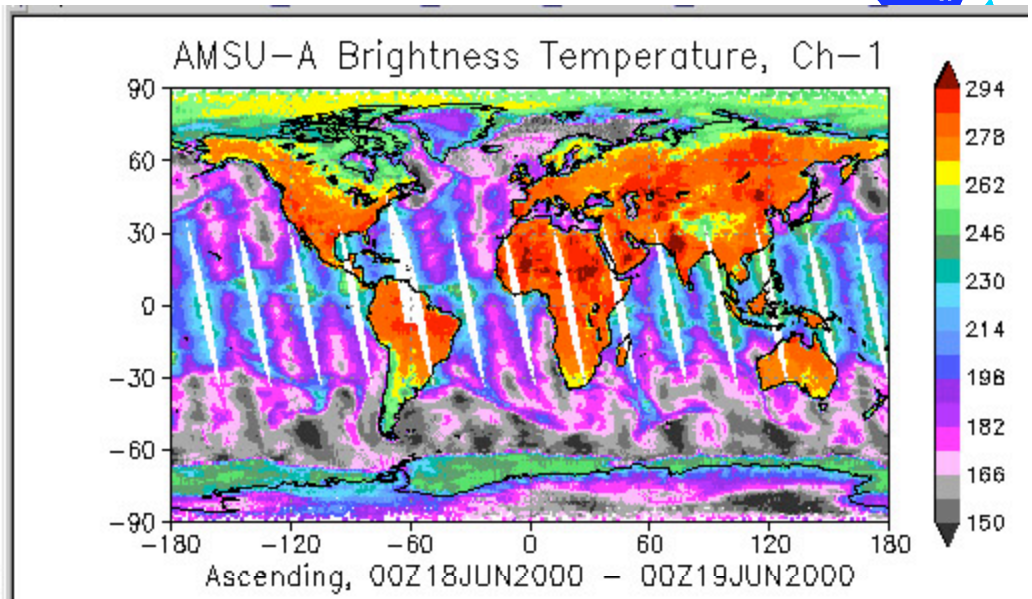


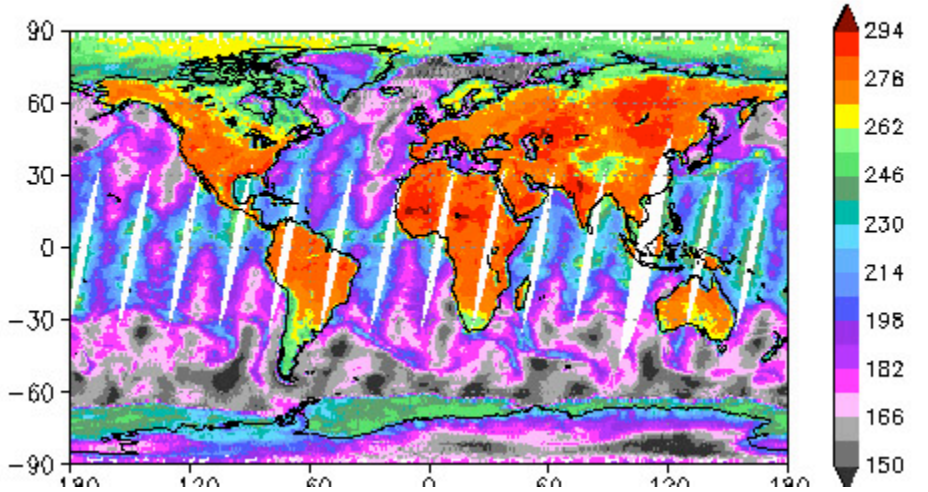
Simulated AMSU





Real AMSU



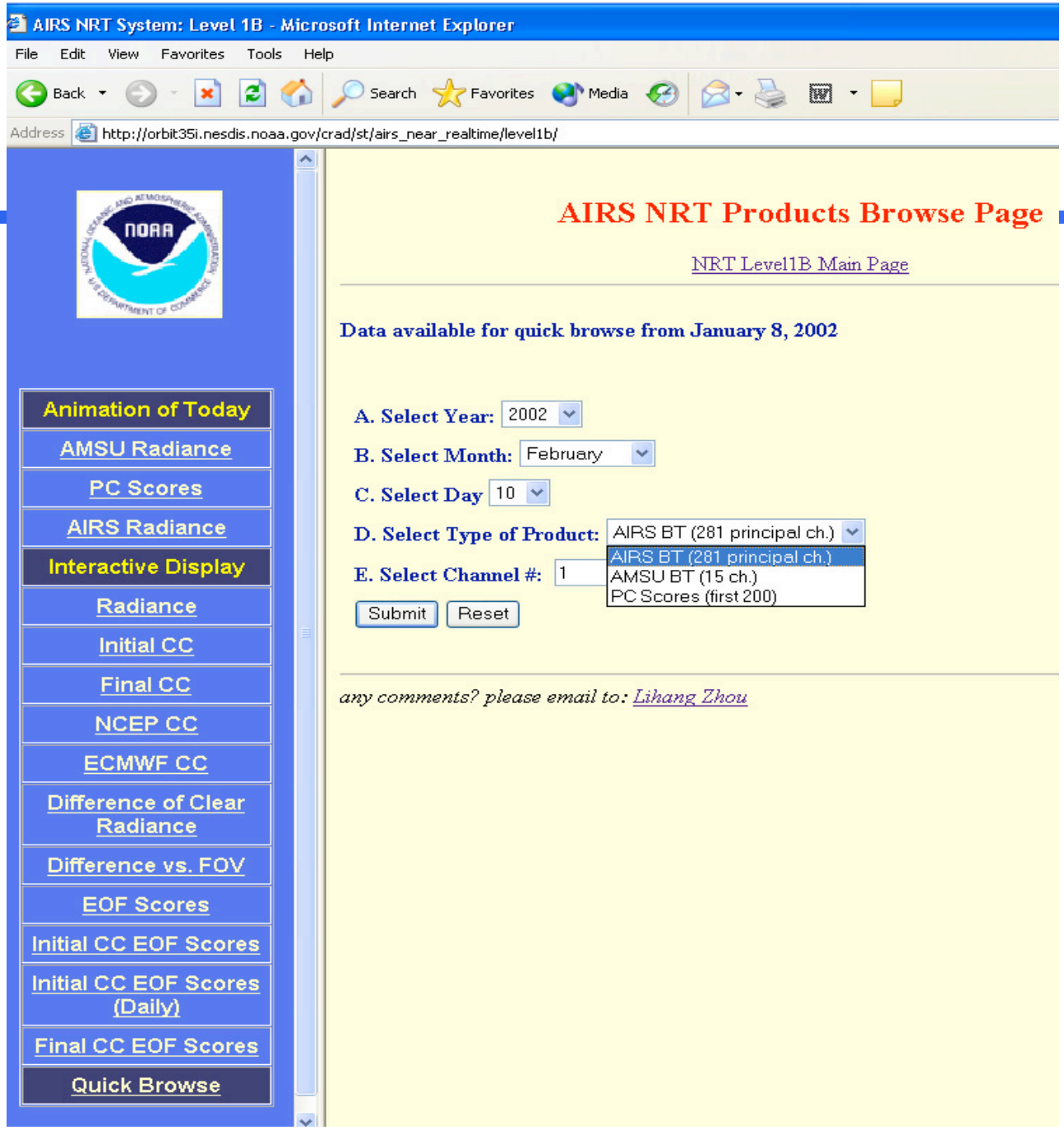


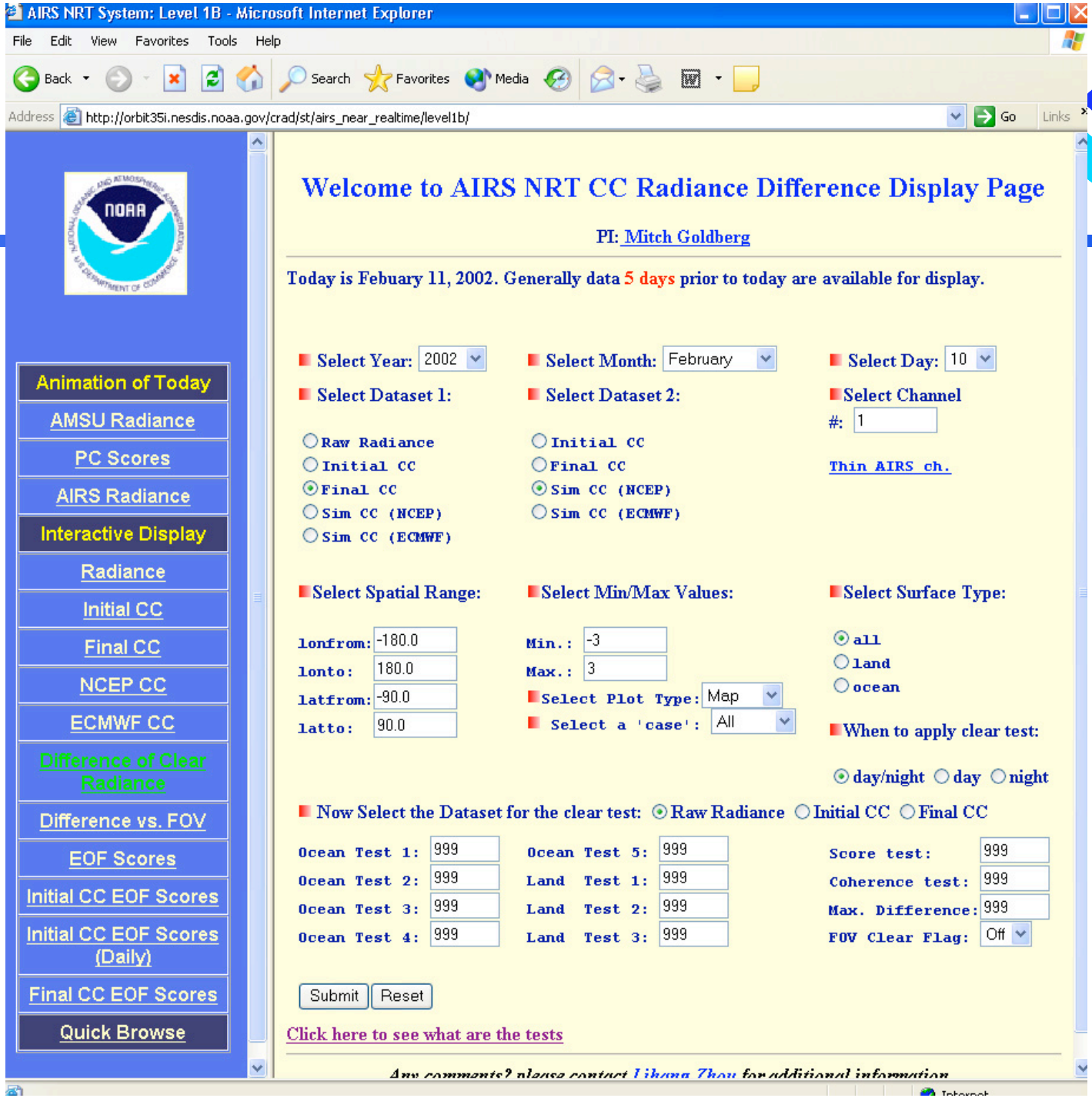
Offline system for monitoring/validation

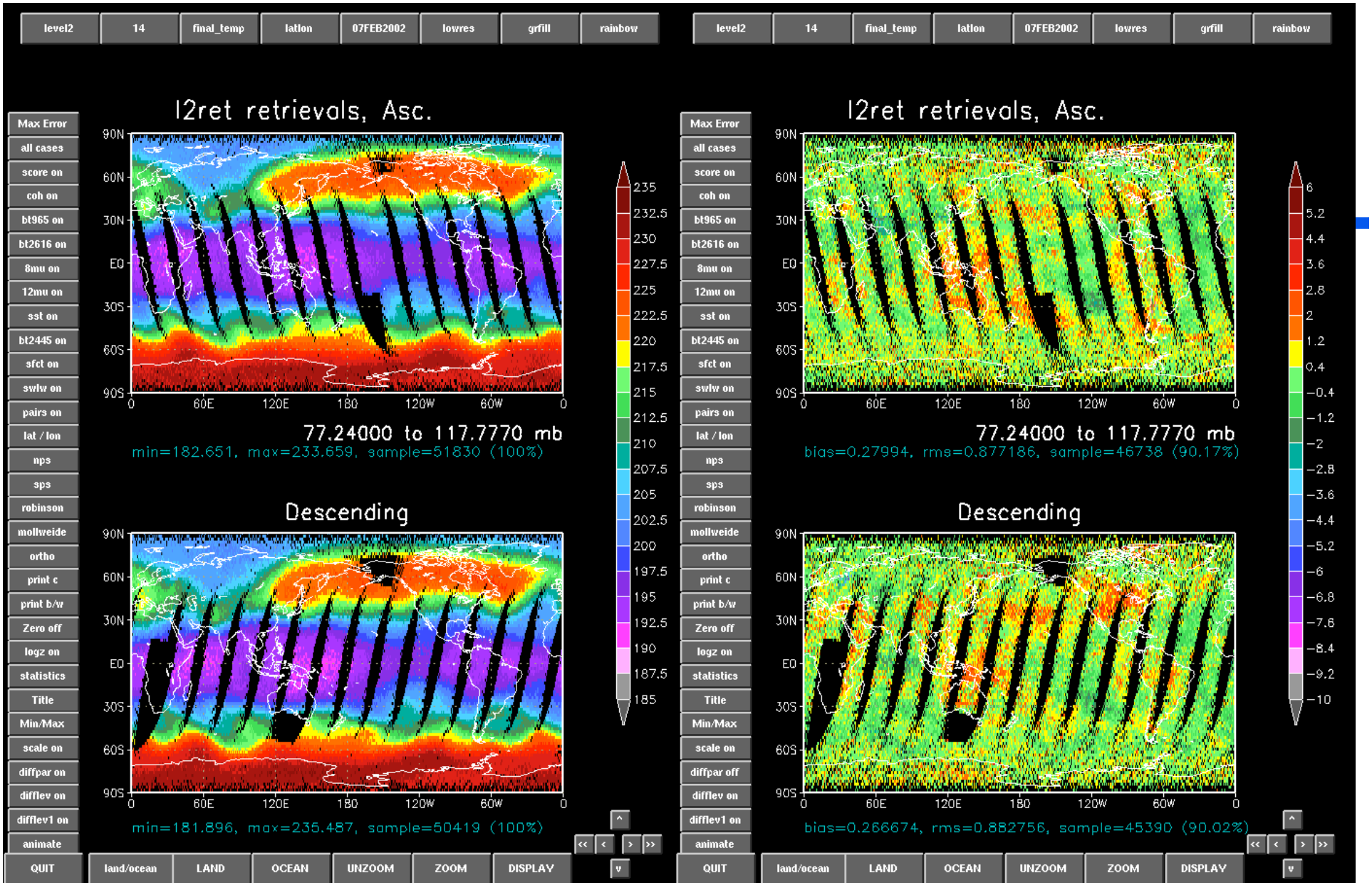
- Daily Global Grids (0.5 x 2.0 resolution) of
  - observed radiances (center fov)
  - cloud cleared radiances
  - principal component scores of above
  - retrievals from level 2 support file
  - NCEP and ECWMF forecasts
  - clear simulated radiances from NCEP and ECMWF

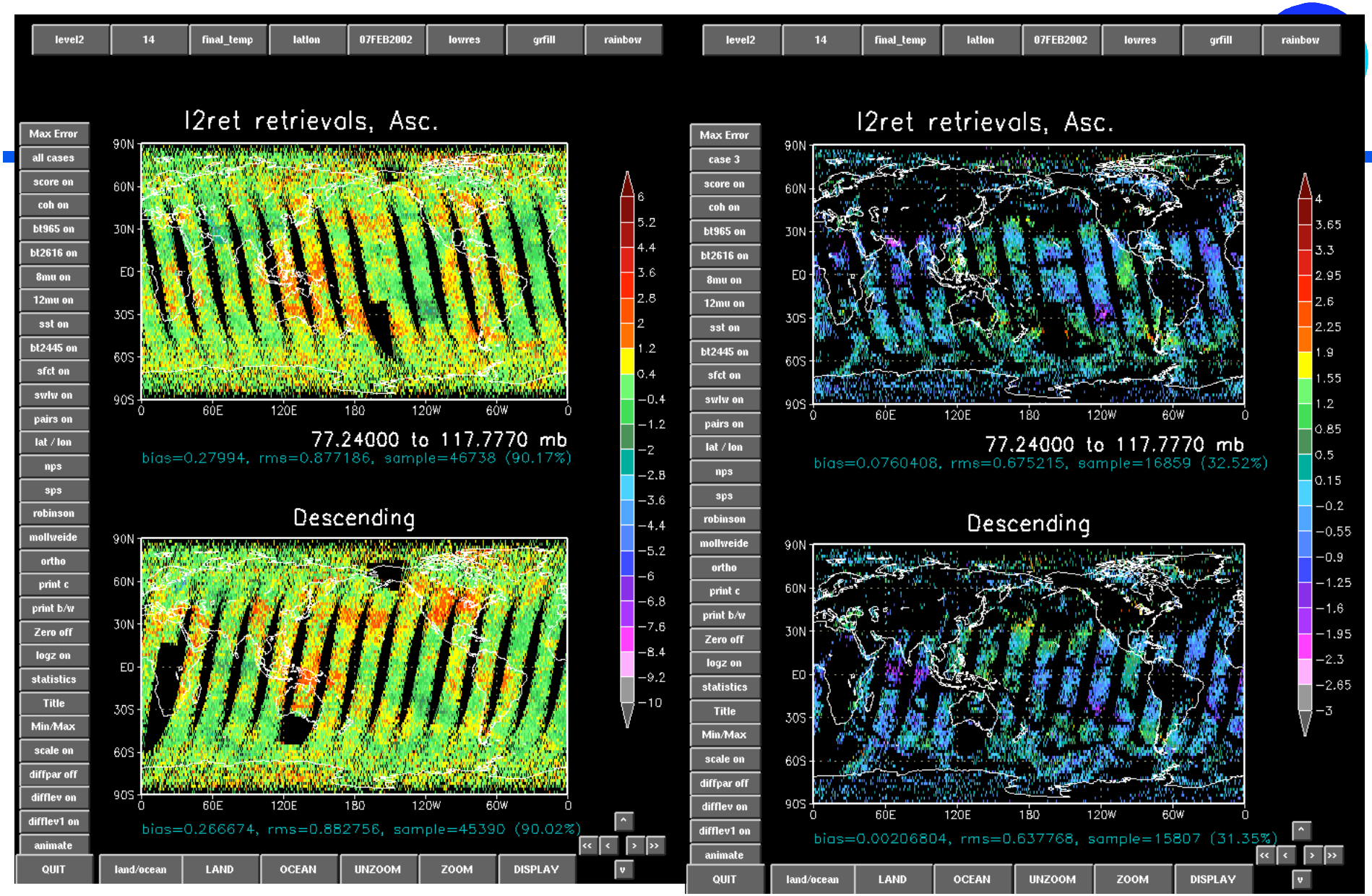
- Radiosonde collocations

Key to validation of NRT products as well as generation of coefficients.


AIRS NRT System: Level 1B - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://orbit35i.nesdis.noaa.gov/crad/st/airs_near_realtime/level1b/
Animation of Today
AMSU Radiance
PC Scores
AIRS Radiance
Interactive Display
Radiance
Initial CC
Final CC
NCEP CC
ECMWF CC
Difference of Clear Radiance
Difference vs. FOV
EOF Scores
Initial CC EOF Scores
Initial CC EOF Scores (Daily)
Final CC EOF Scores
Quick Browse
AIRS NRT Products Browse Page
NRT Level1B Main Page
Data available for quick browse from January 8, 2002
A. Select Year: 2002
B. Select Month: February
C. Select Day 10
D. Select Type of Product: AIRS BT (281 principal ch.)
AIRS BT (281 principal ch.)
AMSU BT (15 ch.)
PC Scores (first 200)
E. Select Channel #: 1
Submit Reset
any comments? please email to: Lihang Zhou

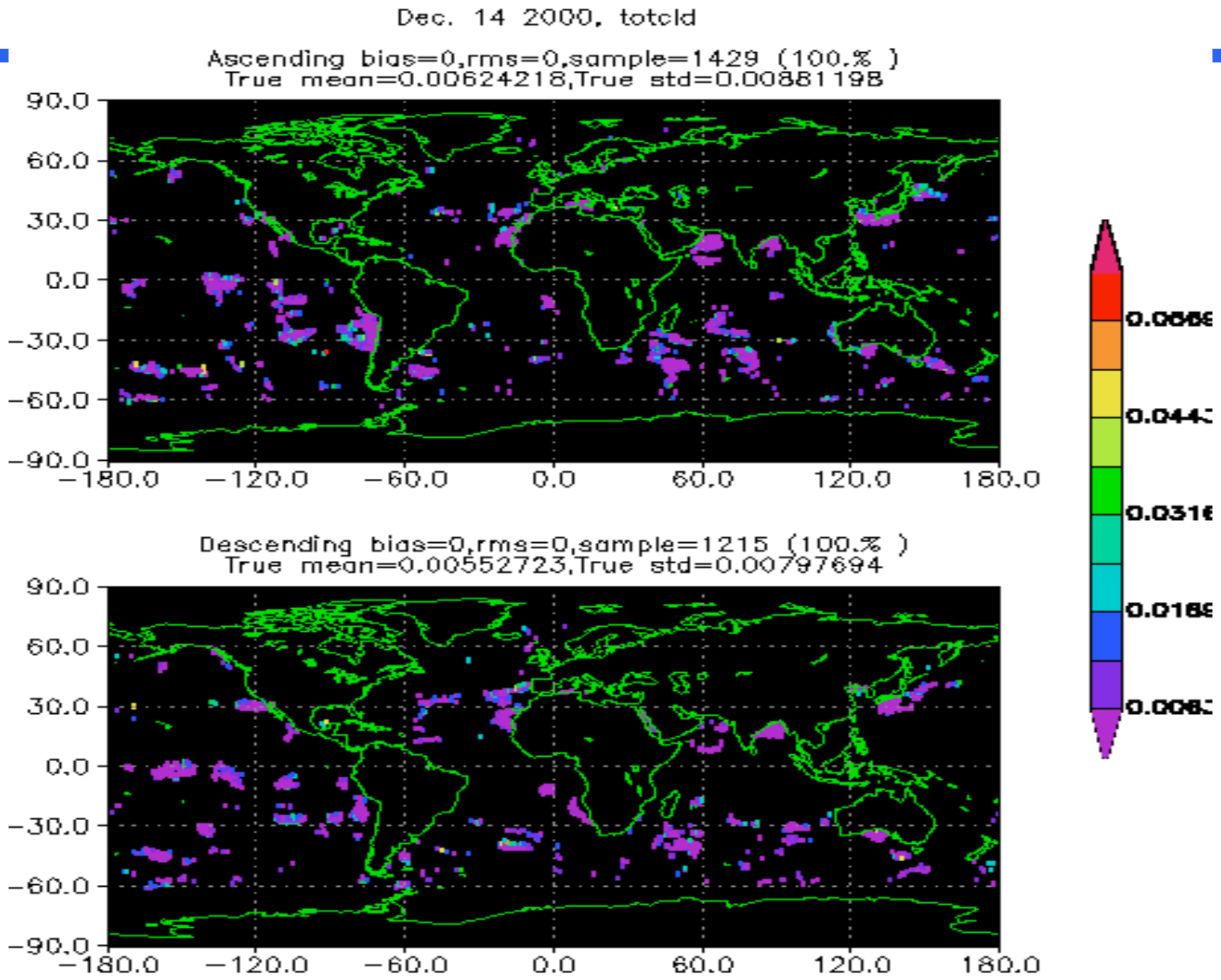

AIRS NRT System: Level 1B - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://orbit35i.nesdis.noaa.gov/crad/st/airs_near_realtime/level1b/
Go Links
Animation of Today
AMSU Radiance
PC Scores
AIRS Radiance
Interactive Display
Radiance
Initial CC
Final CC
NCEP CC
ECMWF CC
Difference of Clear Radiance
Difference vs. FOV
EOF Scores
Initial CC EOF Scores
Initial CC EOF Scores (Daily)
Final CC EOF Scores
Quick Browse
Welcome to AIRS NRT CC Radiance Difference Display Page
PI: Mitch Goldberg
Today is Febuary 11, 2002. Generally data 5 days prior to today are available for display.
Select Year: 2002
Select Month: February
Select Day: 10
Select Dataset 1:
Raw Radiance
Initial CC
Final CC
Sim CC (NCEP)
Sim CC (ECMWF)
Select Dataset 2:
Initial CC
Final CC
Sim CC (NCEP)
Sim CC (ECMWF)
Select Channel #: 1
Thin AIRS ch.
Select Spatial Range:
lonfrom: -180.0
lonto: 180.0
latfrom: -90.0
latto: 90.0
Select Min/Max Values:
Min.: -3
Max.: 3
Select Plot Type: Map
Select a 'case': All
Select Surface Type:
all
land
ocean
When to apply clear test:
day/night day night
Now Select the Dataset for the clear test: Raw Radiance Initial CC Final CC
Ocean Test 1: 999
Ocean Test 2: 999
Ocean Test 3: 999
Ocean Test 4: 999
Ocean Test 5: 999
Land Test 1: 999
Land Test 2: 999
Land Test 3: 999
Score test: 999
Coherence test: 999
Max. Difference: 999
FOV Clear Flag: Off
Submit Reset
Click here to see what are the tests
Any comments? please contact Lihang Zhou for additional information


level2
14
final_temp
latlon
07FEB2002
lowres
grfill
rainbow
Max Error
all cases
score on
coh on
bt965 on
bt2616 on
8mu on
12mu on
sst on
bt2445 on
sfct on
swlw on
pairs on
lat / lon
nps
sps
robinson
mollweide
ortho
print c
print b/w
Zero off
logz on
statistics
Title
Min/Max
scale on
diffpar on
difflev on
difflev1 on
animate
QUIT
land/ocean
LAND
OCEAN
UNZOOM
ZOOM
DISPLAY
l2ret retrievals, Asc.
77.24000 to 117.7770 mb
min=182.651, max=233.659, sample=51830 (100%)
Descending
min=181.896, max=235.487, sample=50419 (100%)
l2ret retrievals, Asc.
77.24000 to 117.7770 mb
bias=0.27994, rms=0.877186, sample=46738 (90.17%)
Descending
bias=0.266674, rms=0.882756, sample=45390 (90.02%)

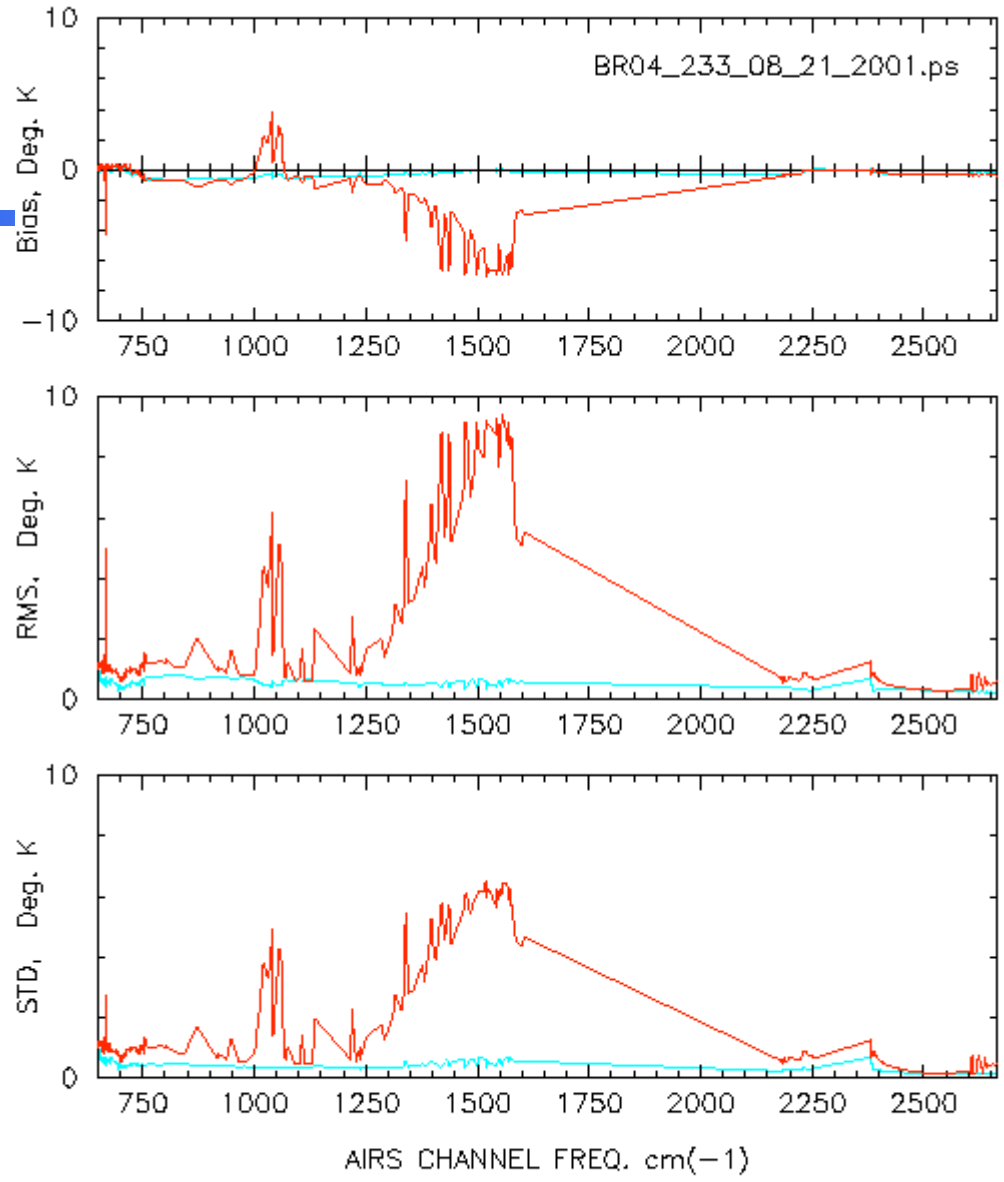

level2
14
final_temp
latlon
07FEB2002
lowres
grfill
rainbow
Max Error
all cases
score on
coh on
bt965 on
bt2616 on
8mu on
12mu on
sst on
bt2445 on
sfct on
swlw on
pairs on
lat / lon
nps
sps
robinson
mollweide
ortho
print c
print b/w
Zero off
logz on
statistics
Title
Min/Max
scale on
diffpar off
difflev on
difflev1 on
animate
QUIT
land/ocean
LAND
OCEAN
UNZOOM
ZOOM
DISPLAY
l2ret retrievals, Asc.
77.24000 to 117.7770 mb
bias=0.27994, rms=0.877186, sample=46738 (90.17%)
Descending
bias=0.266674, rms=0.882756, sample=45390 (90.02%)
l2ret retrievals, Asc.
case 3
77.24000 to 117.7770 mb
bias=0.0760408, rms=0.675215, sample=16859 (32.52%)
Descending
bias=0.00206804, rms=0.637768, sample=15807 (31.35%)

Clear detection

ONLY 0.5% residual clouds



N_16_233_08_21_2001__16_293_10_20_2001 NCH: 281 N: 217 CASE: 4



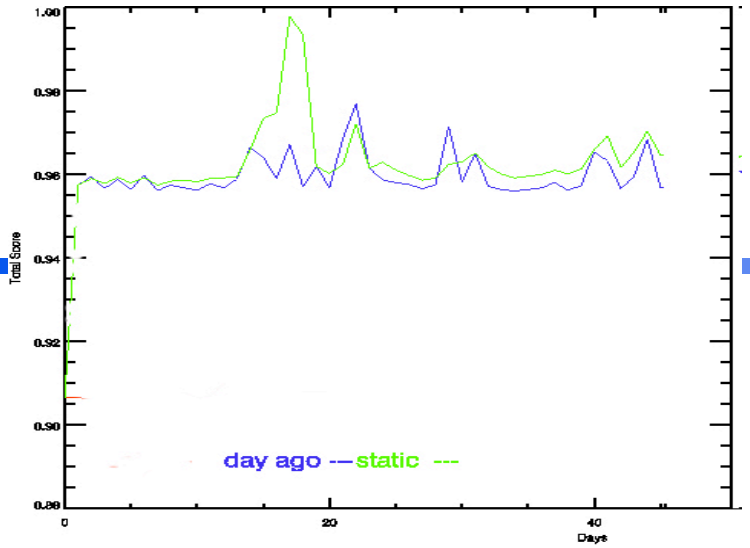
281 CH, OBS(Grid) − Sim(MF) CLR NSAMPLES : 217

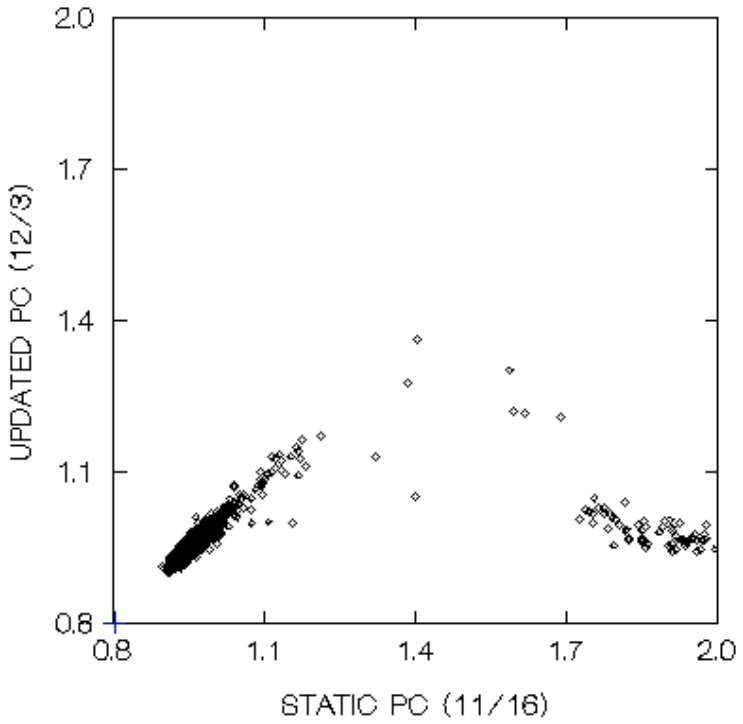
281 CH, OBS(Grid) − Sim(RAOB) CLR NSAMPLES : 217

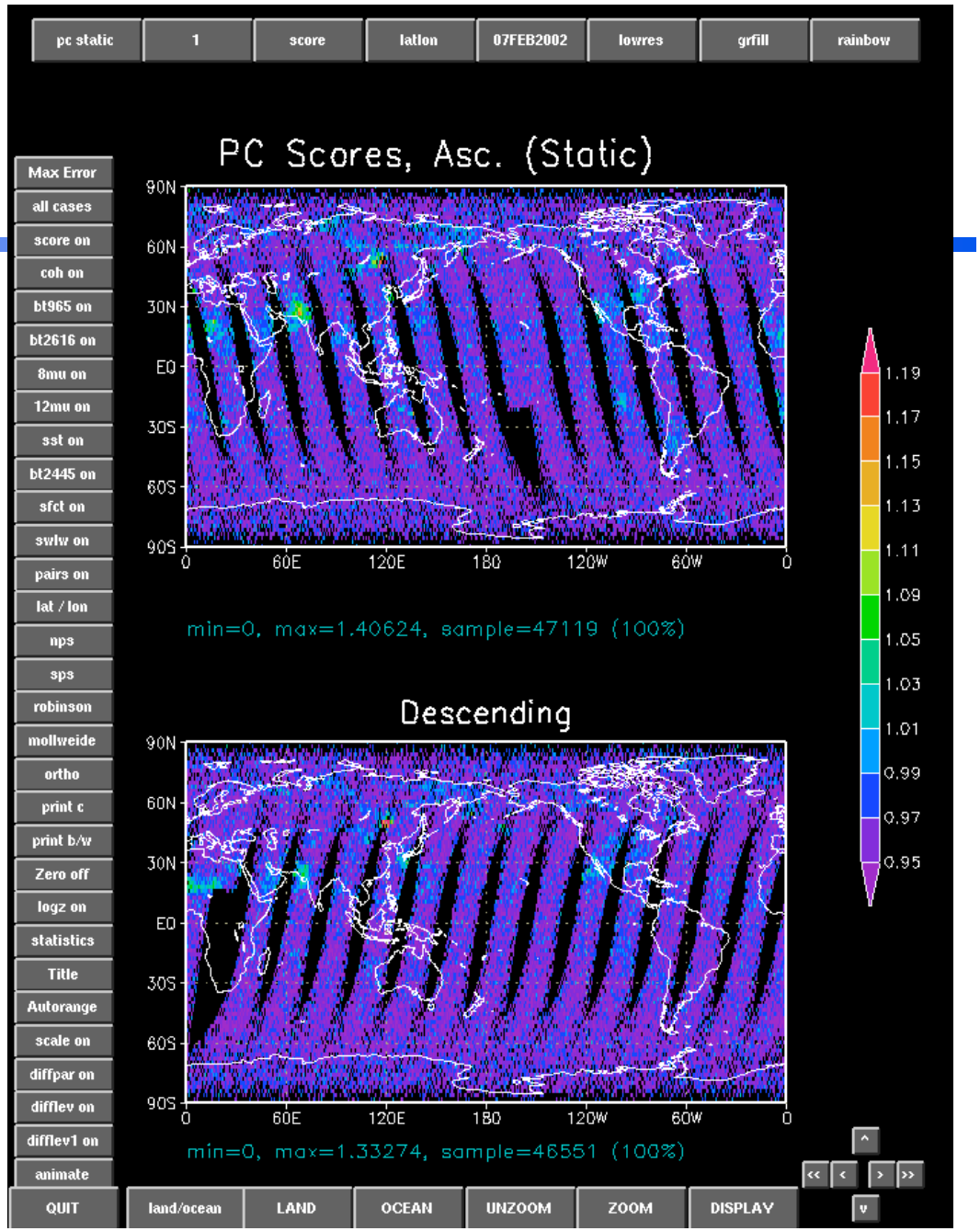
Offline monitoring of coefficients

Monitor

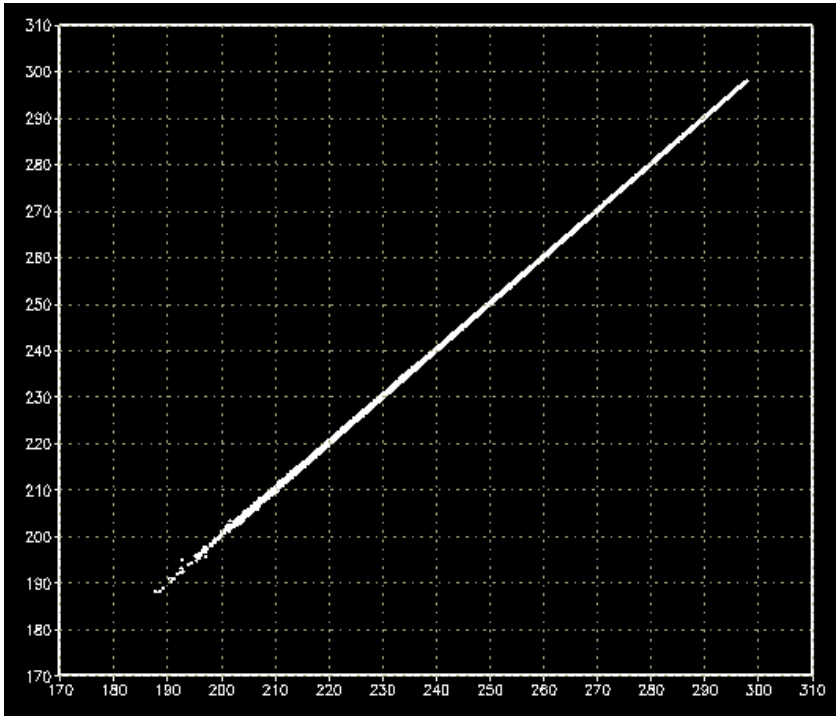
- Monitor representation of eigenvectors
- Monitor representation of regression coefficients

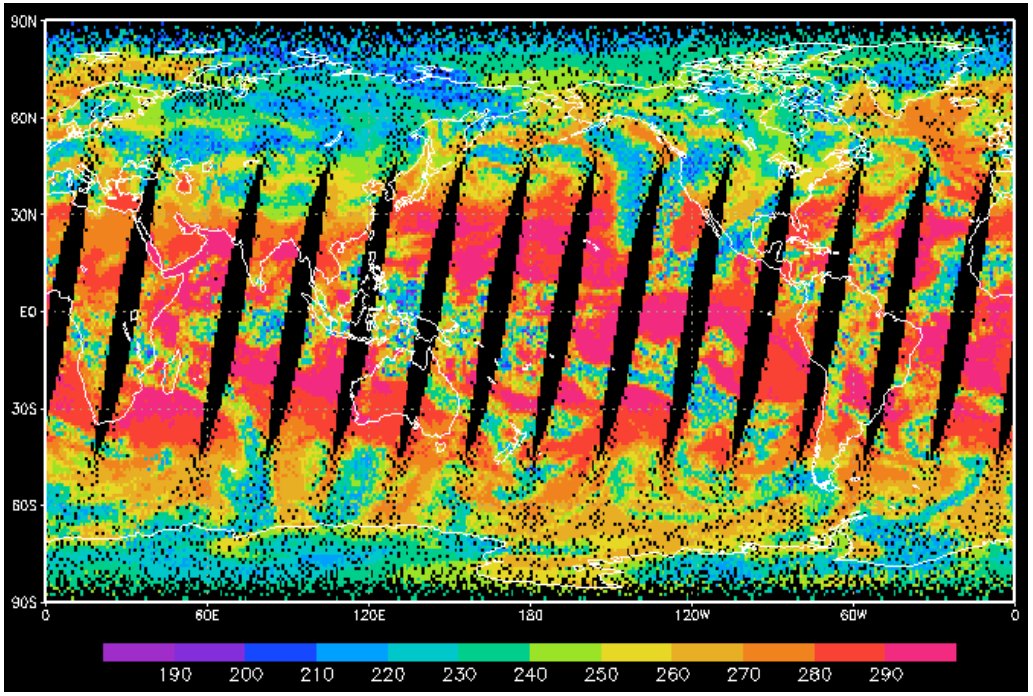

Total Score
Days
day ago --static ---

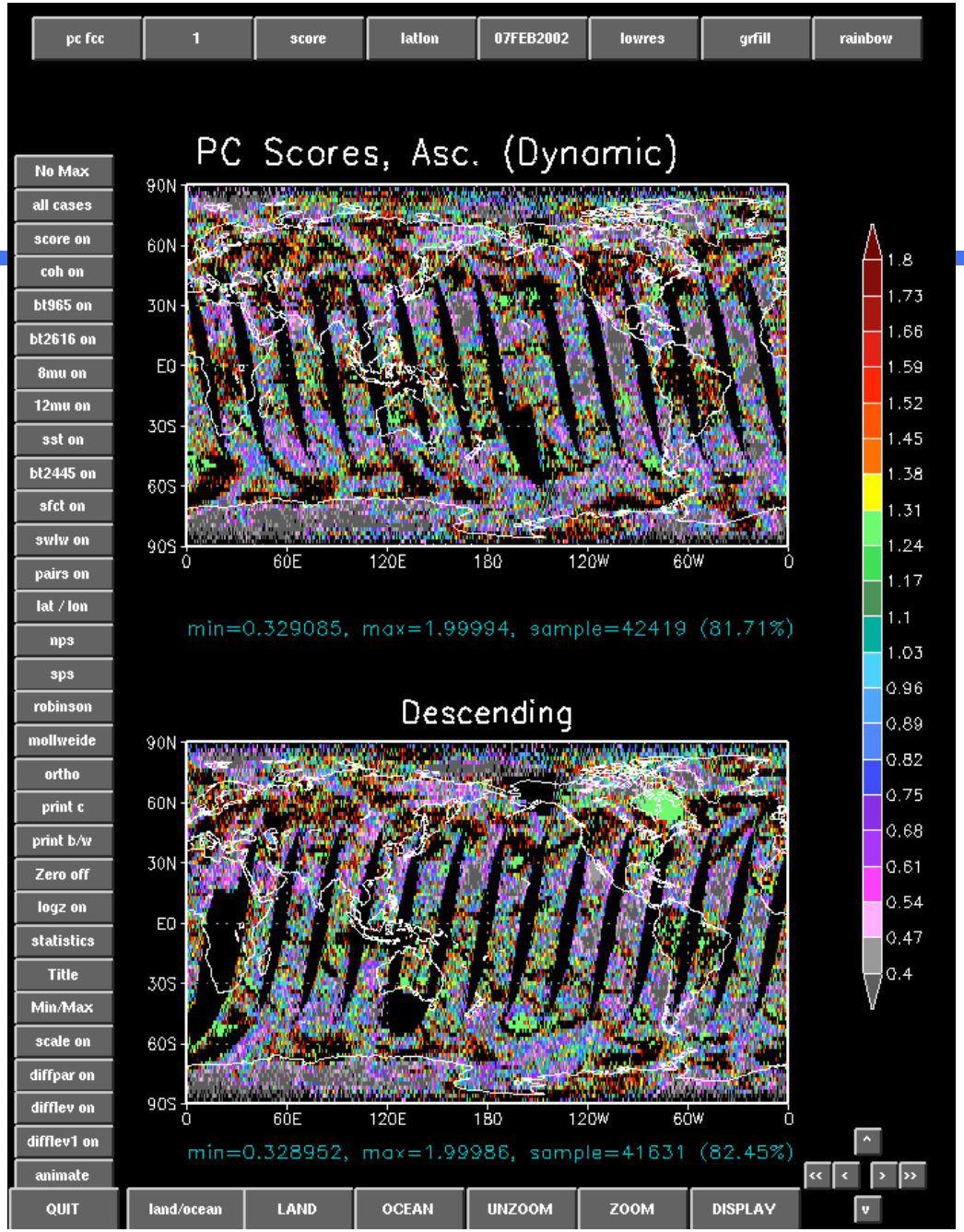

UPDATED PC (12/3)
STATIC PC (11/16)


pc static
1
score
lation
07FEB2002
lowres
grfill
rainbow
PC Scores, Asc. (Static)
Max Error
all cases
score on
coh on
bt965 on
bt2616 on
8mu on
12mu on
sst on
bt2445 on
sfct on
swlw on
pairs on
lat / lon
nps
sps
robinson
mollweide
ortho
print c
print b/w
Zero off
logz on
statistics
Title
Autorange
scale on
diffpar on
difflev on
difflev1 on
animate
min=0, max=1.40624, sample=47119 (100%)
Descending
min=0, max=1.33274, sample=46551 (100%)
QUIT
land/ocean
LAND
OCEAN
UNZOOM
ZOOM
DISPLAY

965 cm-1 reconstruction






pc fcc
1
score
latlon
07FEB2002
lowres
grfill
rainbow
PC Scores, Asc. (Dynamic)
No Max
all cases
score on
coh on
bt965 on
bt2616 on
8mu on
12mu on
sst on
bt2445 on
sfct on
swlw on
pairs on
lat / lon
nps
sps
robinson
mollweide
ortho
print c
print b/w
Zero off
logz on
statistics
Title
Min/Max
scale on
diffpar on
difflev on
difflev1 on
animate
90N
60N
30N
EQ
30S
60S
90S
0
60E
120E
180
120W
60W
0
min=0.329085, max=1.99994, sample=42419 (81.71%)
Descending
min=0.328952, max=1.99986, sample=41631 (82.45%)
1.8
1.73
1.66
1.59
1.52
1.45
1.38
1.31
1.24
1.17
1.1
1.03
0.96
0.89
0.82
0.75
0.68
0.61
0.54
0.47
0.4
QUIT
land/ocean
LAND
OCEAN
UNZOOM
ZOOM
DISPLAY

Ready for Day 70

- Generate eigenvectors -- examine information content
- Look at clear detection
- Generate retrieval coefficients using collocate PCS and ECMWF
- Compare regression retrievals with ECWMF (sanity check)
- Look at measured - computed

Walter Readiness

Required Tasks

- Convert RBD Data to PDS format
- Convert GBAD PDS to DAAC Level-1 code
- Set up the input PCF files for the Level-0 processing
- Run the Level-0 to Level-1B code
- Subset the Level-1B radiances/BTs and produce the deliverable BUFR files

MOSS 6 Test

- Received 56 Files of Rate Buffered Data for each Instrument
- The latency time for NOAA to get the RBD data is being investigated

RBD to PDS

- Conversion of Rate Buffered Instrument Data to PDS (Production Data Set) Format
- Conversion of Rate Buffered GBAD 1 Second data to PDS Format
- Conversion of PDS GBAD data to DAAC Level 1 Format
- Updated version of GBAD conversion code needs to be downloaded and installed

AIRS Level 0 to Level 1B

- Currently in the process of installing the code
- Need to automate PCF file generation
- Need to automate the Level 0 to Level 1B production

Deliverable BUFR Files

- The data subsetter and BUFR converter is in production - Operational Version
- 281 Channel set is being produced for the center FOV of every other golf ball
- Data missing from BUFR files: Visible, cloud tests, and quality flags

Level 1B Matchups

- The Level 1B Matchups are in Operations.
- Closest AIRS point to a given location within the time and distance requirements
- Quality Flags need to be added to the matchup file

Summary

- All the pieces are in place
- Pieces need to be put together to make an Operational System